

Electronic Poster: RTT track: Treatment planning and dose calculation

EP-1629
Dose sparing potential of deep inspiration breath-hold technique for left breast radiotherapy organs-at-risk
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Purpose/Objective: To assess if DIBH achieved dose sparing for organs-at-risk in left breast radiotherapy. These patients have an increased risk of cardiac complications post-treatment compared to right breast patients. Deep inspiration breath-hold (DIBH) could potentially reduce dose to organs-at-risk without compromising target dose, thus potentially reducing complication incidence and improving overall patient survival.

Materials and Methods: Free breathing (FB) and DIBH CT planning scans obtained using Varian RPM Gating software for 28 left breast/left chest wall (plus/minus supracavicular field) patients treated between January 2008-December 2013 were retrospectively re-contoured and re-planned. Organs-at-risk included the combined lungs, left lung, heart and left anterior descending coronary artery (LADCA). Field-in-field tangential technique (mono-isocentric for supraclavicular treatment fields. LADCA $D_{\text{mean}}$ was reduced by 47.8% (FB mean=15.56Gy, SD=10.62Gy vs. FB mean=29.82Gy, SD=10.05Gy, $p<0.000$), and LADCA $D_{\text{mean}}$ by 52% (FB mean=5.23Gy, SD=1.94Gy vs. FB mean=10.88Gy, SD=3.95Gy $p<0.000$). Amplitude depths were not correlated with dose reductions.

Conclusions: DIBH results in heart and LADCA dose reductions, without increasing lung dose. Further long-term follow-up is required to evaluate the clinical implications for patients.

EP-1630
Fixed-Jaw technique in volumetric modulated arc therapy plan for nasopharyngeal carcinoma
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Purpose/Objective: To compare the dosimetric difference of volumetric modulated arc therapy (VMAT) and fixed-jaw technique in volumetric modulated arc therapy (FJT-VMAT) for nasopharyngeal carcinoma (NPC).

Materials and Methods: VMAT and FJT-VMAT plans were designed to 15 nasopharyngeal carcinoma patients by planning treatment system (Eclipse 10.0), respectively. The target and risk organ doses, conformity indexes (CI), homogeneity indexes (HI), low dose volume of normal tissue, monitor units (MU) and treatment time (TT) were compared between the two kinds of plans.

Results: Two Plans could meet the clinical objectives. The $D_{\text{mean}}$, $D_{\text{50}}$, $D_{\text{2}}$ of PGTVn, $D_{\text{mean}}$ of PTV1, $D_{\text{mean}}$ of PTV2 were lower in VMAT plans than in VMAT plans ($p<0.05$). There were no significant different in PGTVnx between them. FJT-VMAT plans had lower $PRV_{\text{mean}}$, $PRV_{\text{max}}$, parotid ($D_{\text{mean}}$, $V_{20}$) and B-P ($V_{20}$, $V_{30}$) ($p<0.05$), but no significantly different with other OARs as compared with VMAT plans. FJT-VMAT plans (683±87) increased the monitor units (MU) by 22% ($t=5.78, p<0.000$), as compared with VMAT plans (559±62). The treatment time of two plans were consistent (about 2 min).

Conclusions: FJT-VMAT plans as compared with VMAT plans, showing better target coverage, part of OARs and B-P sparing, which MU was slightly increased but not significantly different between the two plans of treatment time.

EP-1631
A method to achieve homogeneous dose distribution in the IMRT for Stage III lung cancer
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Purpose/Objective: To achieve homogeneous dose distribution in the intensity-modulated radiotherapy (IMRT) for Stage III lung cancer is challenging. A novel method utilizing base dose function (BDF) was proposed to overcome the difficulty and was evaluated in this study.

Materials and Methods: CT scan data of 13 patients were enrolled. Three optimizing approaches were applied to obtain clinically acceptable plans: 1) Conventional optimizing (CO)
method; 2) Target-divided optimizing (TDO) method in which the optimization objective was set to 2-4 Gy higher for the planning target volume (PTV) within lung; 3) Base-dose-function (BDF) method: with optimization objectives being unmodified, the treatment plan copied from the original plan with half of total fractions was re-optimized based on the original plan with half of total fractions, and then the number of fractions of treatment plan was restored from a half to the total one. CO, TDO and BDF methods were then compared in PTV homogeneity index (HI), conformity index (CI), organs at risk (OARs) sparing and monitor units (MUs). Additionally, three verification tools, Delta4, Portal Dosimetry and IMSure were employed to measure the dose delivery accuracy.

Results: BDF method provided superior HI over TDO and CO methods by about 38% and 54% respectively, and provided superior CI over TDO and CO methods by about 3% and 7% respectively. Considering the OARs sparing, BDF method reduced the dose delivered to the lung, spinal cord, esophagus and heart by about 0.2-3.8Gy. However, the BDF plans needed about 9-15% more monitor units (MUs) than the other two methods. All the verification results had good and comparable y pass rates among the 3 methods.

Conclusions: The proposed BDF method can achieve excellent homogeneous dose distribution, and it can also improve the target conformity as well as the OARs sparing, in the IMRT for Stage III lung cancer.

EP-1632
Definition and evaluation of a template to speed up radiosurgery treatment planning of acoustic neurinomas
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Purpose/Objective: A Generic Template with no specific adjustments for tumour type is used at our hospital for linear accelerator-based radiosurgery treatment planning. It involves further manual adjustments of the micro-multileaf collimator (mMLC) leaves in all the generic arcs for improving the treatment plan quality which is a cumbersome task. The purpose of this work is to present specific templates for right and left acoustic neurinomas and compare their performance with the Generic Template in terms of plan quality, and to determine the minimum number of arcs where the mMLC shape must be adjusted for the treatment plan to comply with the local acceptability criteria.

Materials and Methods: The treatment plans of 12 cases of already treated right acoustic neurinomas were analysed. From this retrospective study, a Specific Template for right acoustic neurinoma was created and the Specific Template for left acoustic neurinoma was defined as precisely the mirror of the right template. In total, 19 cases involving acoustic neurinomas have been re-planned with the Specific Template (right or left) and their plan quality assessed. Treatment planning was conducted using the iPlan RT Dose planning system, version 4.5 from BrainLAB. The target volumes ranged from 0.265-7.523 cc (mean: 2.085 ± 1.772 cc) and the prescribed dose was 12-14 Gy (mean: 12.15 ± 0.50 Gy). Treatment plans were generated using 6 dynamic conformal arcs and their quality evaluation was assessed through the calculation of dose-volume indices and dose distribution analysis.

Results: The Specific Template performed better than the Generic Template in terms of conformity (COIN = 0.558 ± 0.034 for the Specific Template and COIN = 0.547 ± 0.034 for the Generic Template) and critical organ sparing (COIN = 0.554 ± 0.031 for the Specific Template and COIN = 0.538 ± 0.031 for the Generic Template). The coverage and the homogeneity of the dose distribution were similar for both: TC = 0.981 ± 0.007, MDPD = 1.065 ± 0.013 for the Specific Template and TC = 0.984 ± 0.007, MDPD = 1.067 ± 0.013 for the Generic Template.

Conclusions: Applying the proposed Specific Template for acoustic neurinoma, the compliance to local acceptance quality criteria was achieved with manual correction of the mMLC leaves for just two of the six dynamic arcs used for treatment. This represented a considerable reduction - to around 1/3 - of the treatment planning time, accomplishing the purpose of the present work which was speeding up the treatment planning phase in radiosurgery without jeopardizing the plan quality.

EP-1633
Analysis of Dose-Volume Histogram parameters on prediction esophageal toxicity in radiotherapy for lung tumors
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Purpose/Objective: Esophageal toxicity is a common acute side-effect of external radiotherapy for chest tumors. There is no clear relation with different etiologies as esophageal doses, length of irradiated organ, volumes, etc. Dose-volume histogram (DVH) shows several parameters that can help us to understand this toxicity.

Our objective was to analyze esophageal toxicity at the end of radiotherapy treatment and relate it with the DVH parameters mean dose (Dmean) and maximum dose (Dmax)